



Preparing an Insect Collection

2-1

LAB

Insects are a class of animals in the Phylum Arthropoda. Some scientists estimate that there might be more than 10 000 000 species of insects on Earth although only 750 000 have been classified. Insects are important not just because there are so many of them, but also because they are responsible for pollination of flowers and for production of honey, wax, and silk. They also consume 13 percent of our food crops and are responsible for transmitting organisms that cause many human diseases. Because they are so important to our lives and they are so abundant, insects are excellent organisms for study.

OBJECTIVES

- Collect and prepare an insect collection.
- Recognize and become familiar with the features used to identify insects.

MATERIALS



scissors
white glue
white paper
#2 insect pins (20-30)
fingernail polish remover
(ethyl acetate)

white index cards
(unlined) (2)
facial tissue (4)
insect net (optional)
masking tape
cardboard display box

plastic film cannister
moth balls (crystals)
95% ethanol
10x hand lens
small vials (50 mL)
with stoppers

clean glass jars (approx.
1-L size) with lids (2)
polystyrene foam pieces
(25 cm x 25 cm x 3 cm) (2)
wax marking pencil
small cardboard boxes
(approx. 6)

PROCEDURE

Part A. Collecting Insects

1. Reinforce the two jars with masking tape as shown in Figure 1.
2. Label both jars with a wax marking pencil "POISON." On one write "BUTTERFLIES AND MOTHS" and on the other, write "GENERAL." The jar for butterflies and moths will prevent these delicate insects from being damaged by other, tougher insects.
3. Place two pieces of crumpled tissue in each jar. These jars will serve as chambers for killing the insects.
4. Place one capful, approximately 5-10 mL, of fingernail polish remover on the tissues in the jars when ready to collect insects. The liquid will be effective for a few hours of collecting. Keep lids tightly on the jars except when placing insects in them.

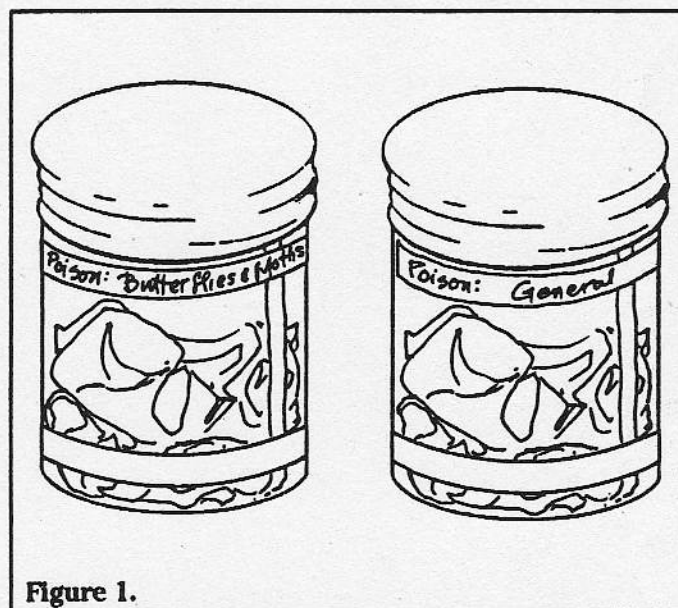


Figure 1.

5. Collect 15 different types of insects from several different habitats. Look under stones, boards, loose bark, shrubs and leaves, inside flowers, and around windows. Flying insects can be collected using an insect net around vegetation during the day or around lights at night. As you collect the insects, write a brief description of the insect, habitat, date, and time of day. This information will help you prepare labels when you return to the lab.
6. Place each insect in the appropriate jar for at least an hour.
7. Place the insects, once they are dead, in small cardboard boxes to hold until pinning. Label the boxes with your name. *DO NOT* place insects in plastic boxes or they will mold before being pinned.

Part B. Preparing Insects

Pin insects within 48 hours of their collection.

1. Prepare a label for each insect as shown in Figure 2. Include the following information on each label:

- ☐ State, County
- ☐ City, Location
- ☐ Date, Time of Day Collected
- ☐ Your Name

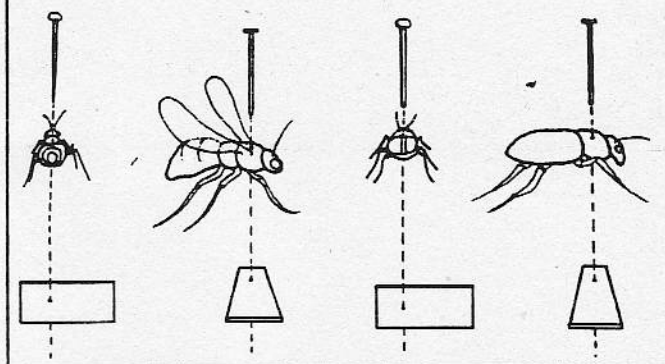
Figure 2.

State: New York St. Lawrence County
 City: Cranberry Lake bog habitat
 Date: June 1, 1990, afternoon
 Collector: J.W. Cook

Standard Insects

2. Place an insect pin through the thorax so that it runs from the dorsal side to the ventral side as in Figure 3. Place the insect on the upper one-third of the pin. About one-fourth of the top of the pin should be exposed so that all insects are at the same level in the box. Make sure the insect is level on its pin. It should not be tilted in any direction.
3. Pin each insect's label under the insect as in Figure 3.
4. Place the pinned insect onto a piece of polystyrene foam.

Figure 3.

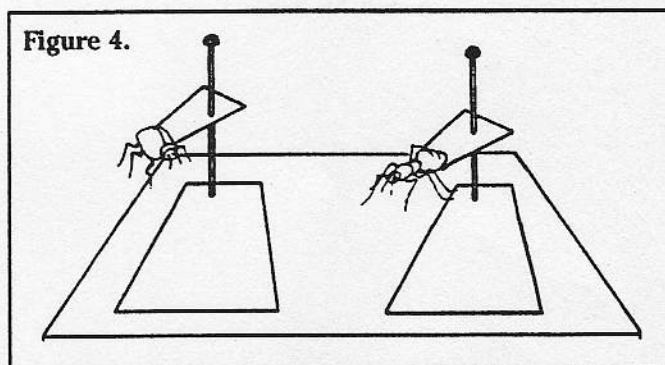


Small Insects

Very small insects (gnats, ants, lice) can be tabbed.

5. Cut a very small triangle from an index card.
6. Place a small dab of glue on the point of the tab. Approach the right side of the insect's thorax with the tab, touching the insect so that it attaches to the tab. After the glue dries, run an insect pin through the tab as shown in Figure 4.

Figure 4.



Moths and Butterflies

Moths and butterflies need special care. After they have been pinned, their wings must be spread and allowed to dry in place.

7. With the point of the scissors, dig a small depression or "ditch" about 3 cm long and 1 cm wide in a piece of polystyrene foam. The size of the body of the insect will determine the size of the depression.
8. Pin the insect body according to steps 1-4 and place it in the depression so that the wings are even with the flat surface of the polystyrene foam. Examine Figure 5.
9. Cut two small strips of the index card and pin one end of each strip over the wings as shown in Figure 6.

10. Position the wings on the right side as shown and pin down the other end of the strip with a second pin. Repeat this procedure with the wings on the left side.
11. Allow the moth or butterfly to dry for at least two days.
12. After the insect is dry, carefully remove the paper strips. Handle these fragile insects gently, touching only their pins.

Aquatic Insects

13. Place each aquatic insect directly into a small vial half filled with ethanol. Use pencil to fill out the label because many inks will wash away in the alcohol. Place the insect label into the vial with the insect. Seal the vials with liquid-tight lids.

Part C. Preparing a Display Box

1. Cut a piece of polystyrene foam so that it fits the bottom of your display box tightly. Place it in the box.
2. Pin the insects in the foam. Insects in vials can be placed in holes in the foam or held in place by tape.
3. Place an uncapped plastic film cannister in the corner of the box and fill it with moth crystals.

Figure 5.

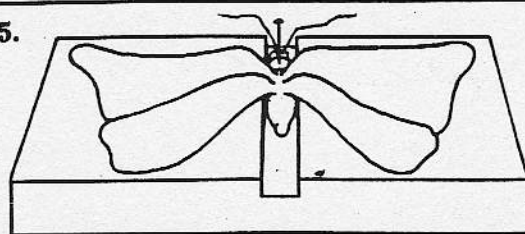
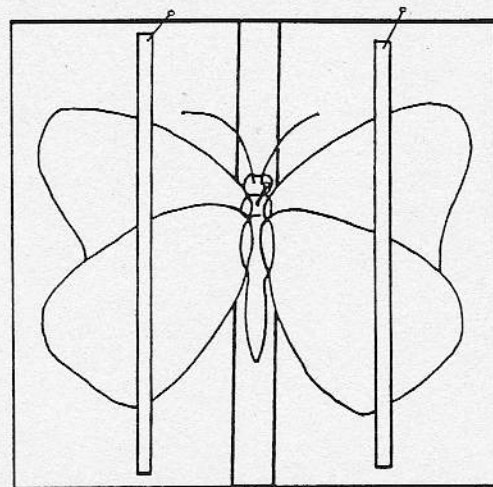


Figure 6.



4. Using a hand lens, study the external features of your insects. Answer the questions in Data and Observations.
5. Complete this Exploration and store the collection for later use in Exploration 21-2.



EXPLORATION

Key to : Identifying Insects

21-2

LAB

- Insects make up a large class in the phylum Arthropoda. Their external anatomical features have been used to classify insects into orders. Insects in the same order share many features and generally look similar to one another. For example, bees and wasps belong to the order Hymenoptera. Insects in different orders might resemble those of other orders at first glance, but a careful look at external characteristics makes it possible to identify them correctly. Biological keys make it easier to use external characteristics to identify the different kinds of insects.

OBJECTIVES

- Become familiar with various insect anatomical characteristics.
- Become familiar with using a biological key.
- Use the characteristics of insects and a biological key to identify insects to their order.

MATERIALS



white adhesive labels
hand lens or stereomicroscope
insect collection from Exploration 2-1

PROCEDURE

1. Use the procedures learned in Investigation 2-2, "Can a Key Be Used to Identify Organisms?", to identify each one of your fifteen insects using the key included with this Exploration under Data and Observations. For assistance with mouth parts, refer to Figure 1. Use the hand lens or a stereomicroscope to help you see the insects' structures.
2. Prepare a label showing the order of each insect you identify.
3. Place the label on the polystyrene board beneath each keyed insect.
4. Turn in your keyed insect collection.

Figure 1.

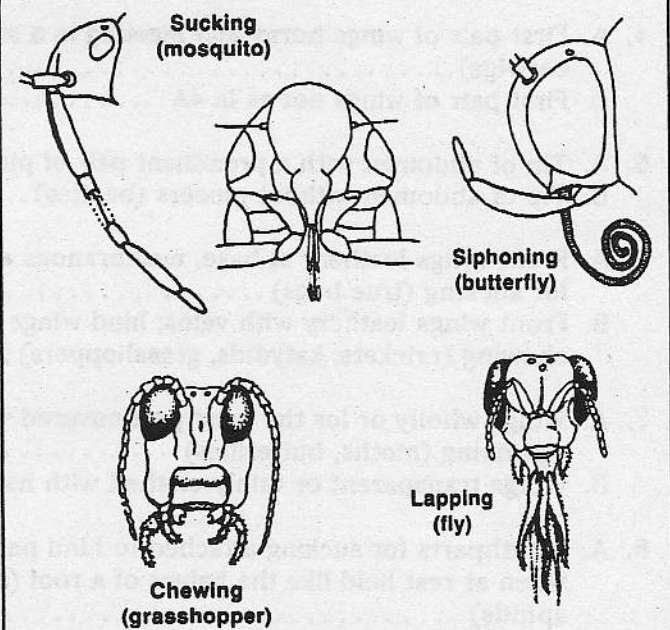
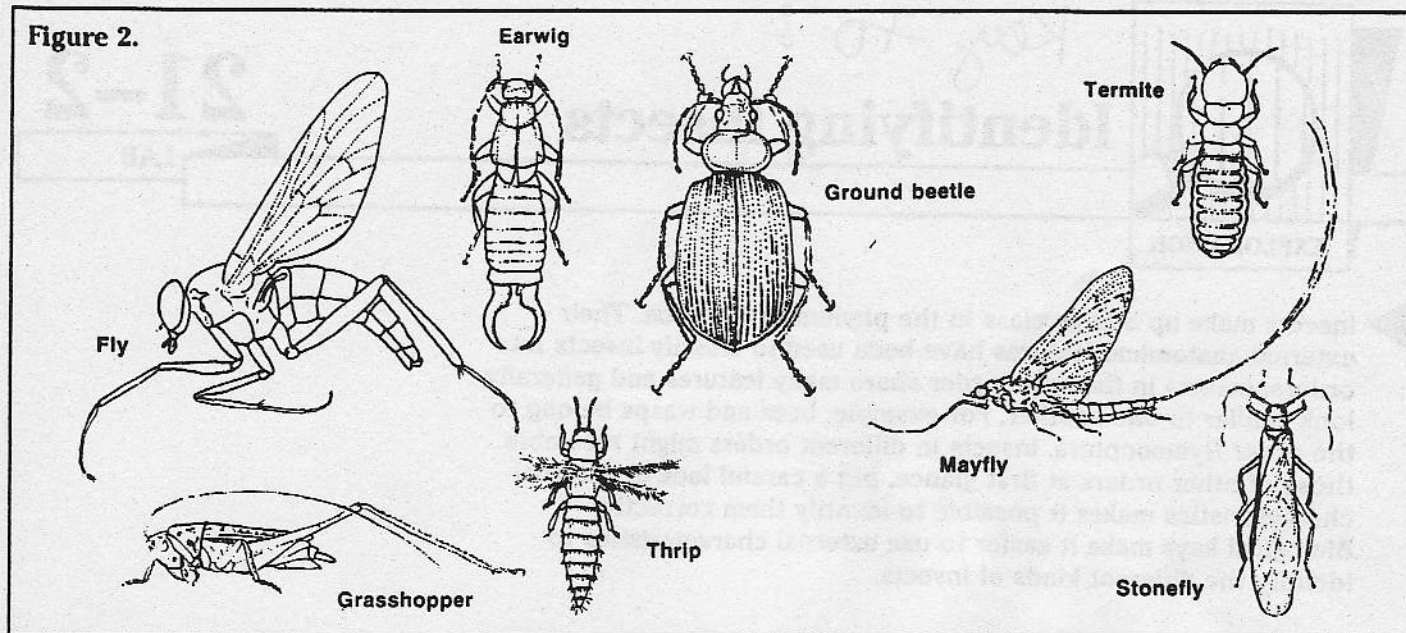


Figure 2.



DATA AND OBSERVATIONS

Key to Insect Orders

1. A. Insects with wings..... Go to 2
 B. Insects without wings or only rudimentary wings Go to 16
2. A. Insects with only one pair of thin, usually transparent wings; second pair replaced with short, pinlike structures (flies, mosquitoes) Order Diptera
 B. Insects with two pairs of wings Go to 3
3. A. Two pairs of wings not alike in structure (not equal in thickness or transparency) (beetles, true bugs, grasshoppers) Go to 4
 B. Two pairs of wings of similar structure (bees, butterflies, dragonflies) Go to 7
4. A. First pair of wings horny and meeting in a straight line down the back (beetles, earwigs)..... Go to 5
 B. First pair of wings not as in 4A Go to 6
5. A. Tip of abdomen with a prominent pair of pincers (earwigs)..... Order Dermaptera
 B. Tip of abdomen without pincers (beetles) Order Coleoptera
6. A. Front wings leathery at base, membranous and overlapping at tip; mouthparts for sucking (true bugs) Order Hemiptera
 B. Front wings leathery with veins; hind wings folded lengthwise; mouthparts for chewing (crickets, katydids, grasshoppers) Order Orthoptera
7. A. Wings wholly or for the most part covered with scales; mouthparts formed for siphoning (moths, butterflies) Order Lepidoptera
 B. Wings transparent or thinly clothed with hairs (bees, mayflies, dragonflies) Go to 8
8. A. Mouthparts for sucking attached to hind part of lower surface of head; wings when at rest held like the halves of a roof (cicadas, leafhoppers, treehoppers, aphids) Order Homoptera
 B. Mouthparts not as in 8A Go to 9

9. A. Body usually brown and slender; insect mothlike, with long slim antennae; no mouthparts evident except for a pair of slender palpi; wings frequently hairy, usually broadest beyond the middle; wings held like halves of a roof over abdomen (caddisflies) Order Trichoptera
 B. Body and other characteristics not as in 9A Go to 10
10. A. Wings with few or no cross veins (bees, thrips) Go to 11
 B. Wings with many cross veins (dragonflies, lacewings) Go to 12
11. A. Front wings the larger pair; hind wings frequently hooked to front wings; mouthparts for lapping, chewing, or sucking (bees, wasps) Order Hymenoptera
 B. Front wings the same size; wings very narrow, bristly hairs at margin (thrips) ... Order Thysanoptera
12. A. Front pair of wings much larger than hind pair; wings held vertically above body; long, fragile-jointed tails behind (mayflies) Order Ephemeroptera
 B. Front pair of wings and other characteristics not as in 12A Go to 13
13. A. Antennae short and inconspicuous; long slender insects with long narrow wings (damselflies, dragonflies) Order Odonata
 B. Antennae longer and conspicuous Go to 14
14. A. Abdomen usually with two short appendages; back wings much broader than front wings folded lengthwise (stoneflies) Order Plecoptera
 B. Abdomen and characteristics not as in 14A Go to 15
15. A. Wings equal in size with many distinct veins; tarsi five-jointed (antlions, lacewings) Order Neuroptera
 B. Wings equal in size with indistinct veins; tarsi four-jointed; thorax in front of wings very short (termites) Order Isoptera
16. A. Insects narrow-waisted, antlike (ants) Order Hymenoptera
 B. Insects not narrow-waisted but still antlike Go to 17
17. A. Bodies antlike but with wide waists, not flattened, light colored (termites) Order Isoptera
 B. Bodies not as in 17A Go to 18
18. A. Insects small and plump, soft-bodied with small heads, two short tubes extending from back of abdomen; sucking mouthparts (aphids) Order Homoptera
 B. Insects not as in 18A Go to 19
19. A. Body of insect small and narrow, flattened on the side; sucking mouthparts; hind legs for jumping; five tarsal segments (fleas) Order Siphonaptera
 B. Body of insect not as in 19A Go to 20
20. A. Body covered thickly with scales; mouthparts for sucking or are absent (butterflies, moths) Order Lepidoptera
 B. Body of insect not as in 20A Go to 21
21. A. Insect very delicate with chewing mouthparts and long, jointed, threadlike tails and antennae (bristletails, firebrats, silverfish) Order Thysanura
 B. Insect not as in 21A Go to 22
22. A. Insect delicate with chewing mouthparts; abdomen of six segments; underside of abdomen frequently has a long, usually double appendage used for leaping (springtails) Order Collembola
 B. Insect not as in 22A Go to 23

23. A. Mouthparts for chewing Go to 24
 B. Mouthparts for sucking Go to 25
24. A. Antennae threadlike; face directed forward and downward (crickets, roaches, grasshoppers, walkingsticks) Order Orthoptera
 B. Antennae beadlike, clublike or comblike, without prominent forceps at tip of abdomen (beetles) Order Coleoptera
25. A. Insect apparently legless, frequently covered with a waxy scale; insect usually tightly attached to plant leaves or stems (scale insects) Order Homoptera
 B. Insect with well developed legs with a sucking beak that arises at front of head and held between the legs (true bugs) Order Hemiptera

ANALYSIS

- The first separation in the key involved the presence or absence of wings. What is another feature that could have been used to separate the insects into two main groups? _____
- Must animals that belong to the same order also belong to the same class? Explain. _____
- Choose two of your insects that are similar to one another. What features make them appear to be similar? _____ What characteristics make it possible to distinguish them? _____
- Would color be a good characteristic to use to classify insects and include in a key? Explain. (Examine other students' collections and compare the same kind of insects.) _____
- List three main characteristics that are used repeatedly in the key to identify the insects. _____

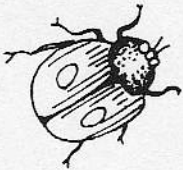
FURTHER EXPLORATIONS

- Prepare a classroom display of the various types of insect mouthparts by drawing and labeling various parts on poster board.
- Consult the library or ask your teacher for biological keys that will allow you to key some of your insects to the family, genus, and species levels. Keying below the level of family usually requires a great deal of care and precision.

INSECT COLLECTION PROJECT GUIDELINES

Your first project in biology is to prepare an insect collection. Although insect collections will not be due until late September, often the weather in the fall prevents you from collecting as many insects as you would like. You are therefore encouraged to do as much of the collection as possible during the summer. Be sure to put mothballs into the container in which you store your insects or they will rot and smell.

As you begin your collection, you should initially try to include each of the following insects, mainly because they are from different orders and are fairly easy to find and identify.



- grasshopper or cricket (or both)
- fly (housefly, blackfly, or mosquito)
- beetle
- butterfly or moth
- wasp or bee
- dragonfly



Please carefully read the attached handouts that explain how to prepare an insect collection. Insects should be mounted, identified, and labeled as shown in Figure 2. If you do not know the order that your specimen belongs to, leave that section blank and we will complete the identification process in class.

*** INSECT COLLECTIONS MUST BE YOUR OWN WORK ***

You may not purchase your insect collection from the Internet, another student, or elsewhere. You may not trade insects with classmates. Failure to follow these guidelines will be considered cheating. Please refer to your student handbook for consequences. **EXCEPTION:** You may receive help from family members provided that they are given credit for their work (identified as the collector on your label)

GRADING CRITERIA

This project will be worth 100 points. In general, 4 points will be awarded for each order represented in your collection and 2 points for each different, correctly labeled specimen. The overall appearance of your collection will be worth 25 points. (OVER)

GRADING RUBRIC - 100 POINTS

OF DIFFERENT ORDERS _____ X 4 =

OF DIFFERENT, CORRECTLY IDENTIFIED SPECIMEN _____ X 2 =

QUALITY OF SPECIMENS

CORRECTLY PINNED/MOUNTED

PROPER LABELS

IDENTIFICATION (ORGANIZED BY ORDER)

NEATNESS

1 2 3 4 5

1 2 3 4 5

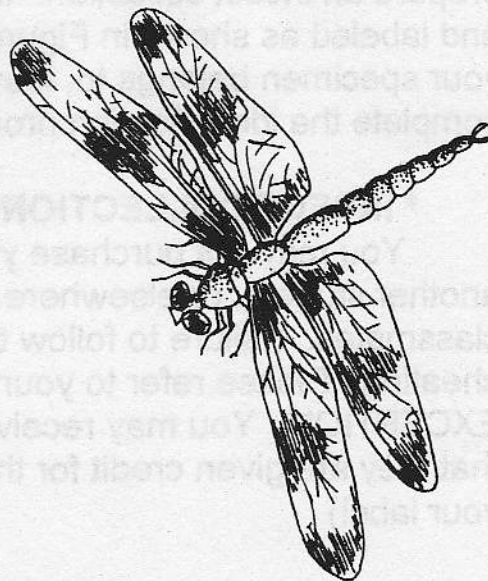
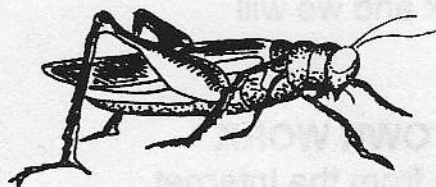
1 2 3 4 5

1 2 3 4 5

1 2 3 4 5

TOTAL: _____

GOOD LUCK & ENJOY!



Alternative Insect Collection: Booklet

If you are unwilling to do an insect collection, you may complete the alternative assignment for a maximum grade of ninety points. To prepare an insect collection booklet, first research the various orders of insects that exist. Three points will be awarded for each order of insect that is represented in the booklet and two points for each correctly identified insect. Therefore, it is in your best interest to select only one insect from each order so that you can earn more points per page. Each page must contain a drawing of the insect as well as an essay describing its habitat, body structure, life cycle, food, etc. (and any other noteworthy characteristics). The insect drawing should be detailed and colored according to how it looks in nature. The booklet should be organized into orders and each page should represent only one insect. The booklet should have a cover page and table of contents. A bibliography must be provided to give credit to the information sources used. The overall appearance of the booklet will be worth thirty points. This means that you could get the maximum grade by drawing 12 insects from different orders, assuming you do not lose points for incorrect identification or on the appearance of the booklet.

Grading Rubric:

(maximum grade = 90 points)

of orders represented x 3 = _____
of correctly identified specimens x 2 = _____

Table of Contents and Cover Page	1	2	3	4	5	6
Drawing (detail,color)	1	2	3	4	5	6
Essay (content, clarity)	1	2	3	4	5	6
Bibliography	1	2	3	4	5	6
Overall effort (neatness, organization)	1	2	3	4	5	6

KEY TO INSECT GROUPS



GRASSHOPPERS, ROACHES, AND THEIR KIN (Orthoptera), pages 17-28. Medium to large insects. Live on land. Forewings leathery. Hindwings folded fan-like (some have no wings). Development gradual. Chewing mouth-parts.

EARWIGS (Dermaptera), page 29. Small insects with typical pincer-like tail. Usually have two pairs of wings. Segmented antennae. Development gradual.

TERMITES (Isoptera), pages 30-31. Ant-like insects, small and soft-bodied. Some have four long wings. Live in colonies. Specialized "castes" for working, fighting. Chewing mouth-parts. Development gradual.

LICE (Anoplura), page 32. Small, wingless insects with piercing and sucking mouth-parts. Body flattened. Legs with claws for clinging to warm-blooded animals.

LEAFHOPPERS, APHIDS, AND SCALE INSECTS (Homoptera), pages 33-41. Small to medium insects, most with two pairs of similar wings held sloping at sides of body. Jointed beak for sucking attached to base of head. Land insects. Some scale-like.

TRUE BUGS (Hemiptera), pages 42-49. Range from small to large in size. Two pairs of wings, with forewings partly thickened. Jointed beak for sucking arises from front of head. Development is gradual.

DRAGONFLIES AND THEIR KIN (Odonata), pages 50-51. Fairly large insects with two pairs of long, equal-sized wings. Body long and slender. Antennae short. Immature insects are aquatic. Development in three stages.

MAYFLIES (Ephemeroidea) **AND** **STONEFLIES** (Plecoptera), page 52. Both with two pairs of transparent, veined wings. In mayflies, hind wings are smaller; in stoneflies they are larger. Mayflies have long, 2- or 3-pronged tails.

NERVE-WINGED INSECTS (Neuroptera), pages 53-55. The two pairs of wings, usually equal in size, are netted with veins. Four stages of development: egg, larva, pupa, and adult. Chewing mouth-parts. Long antennae.



SCORPIONFLIES (Mecoptera), page 56. Small insects with two pairs of slender, generally spotted wings. Legs long. Antennae long also. Beak-like, chewing mouth-parts. Larvae live in soil.



CADDISFLIES (Trichoptera), page 57. Most larvae live in fresh water. Some build ornamented cases. Adults with two pairs of wings with long, silky hairs and with long antennae. Mouth-parts reduced.



MOTHS AND BUTTERFLIES (Lepidoptera), pages 58-101. Medium to large insects with two pairs of scaly wings. Sucking mouth-parts. Antennae knob-like or feathery. Development in four stages.



FLIES AND THEIR KIN (Diptera), pages 102-108. Two-winged, small to medium insects, with sucking mouth-parts. Antennae small, eyes large. Second pair of wings reduced to balancing organs. Development in four stages.



BETTERLES (Coleoptera), pages 109-135. Forewings modified to thickened covers. Hind wings thin, folded. Size from small to large. Chewing mouth-parts. Antennae usually short. All have four life stages. Some aquatic.



BEES, WASPS, AND ANTS (Hymenoptera), pages 136-149. Small to medium-size insects; many social or colonial. Two pairs of thin, transparent wings. Hindwings smaller. Mouth-parts for chewing or sucking. Only insects with "stingers." Development in four stages.

